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ABSTRACT

On January 1, 1970, President Nixon signed into law a bill establishing a national policy to maintain conditions of the environment under which man and nature can exist in productive harmony. In keeping with this, the 1970 National Agricultural Outlook Conference was held, at which the 2 speeches presented in this document were delivered. The first speech, "Environment: The Health Perspective," discusses averting an environmental catastrophe. The second speech, "The Environment and Agriculture," undertakes to answer the following questions about environment: (1) What is it? (2) What are the major factors and interactions determining quality of environment? (3) What is its present condition? (4) What is agriculture's contribution, actual and potential, beneficial and detrimental, to quality of environment? (5) What is being done to improve quality of environment? (6) What kind of environment do we want? It is concluded that efficiency of agriculture is a major determinant in quality of rural, urban, local, and global environments. Agricultural pollution can be resolved by development and application of systems which are technologically effective and socially and economically acceptable. (AN)

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UNITED STATES DEPARTMENT OF AGRICULTURE
Economic Research Service

ENVIRONMENT: THE HEALTH PERSPECTIVE

Talk by Charles C. Johnson, Administrator
Environmental Health Service, Public Health Service
U.S. Department of Health, Education, and Welfare
at the 1970 National Agricultural Outlook Conference
Washington, D.C., 1:30 P.M., Tuesday, February 17, 1970

On January 1, President Nixon signed into law a bill passed by the Congress establishing a National Policy to "maintain conditions under which man and nature can exist in productive harmony." In signing this new measure, he declared that "the nineteen-seventies absolutely must be the years when America pays its debt to the past by reclaiming the purity of its air, its waters, and our living environment. It is literally now or never." In his State of the Union message later in the month, he repeated this call to action. And, just last Tuesday, in a message to the Congress, he outlined a 37-point program, including 23 major legislative proposals and other actions that can be taken without new authority, dealing specifically with water and air pollution control, solid waste management, parklands and public recreation, and organization for action. He stressed again, in this message, that "we can wait no longer to repair the damage already done, and to establish new criteria to guide us in the future."

The President's actions, and the President's words, convey a sense of urgency, and it is an urgency based on fact. For my part, I am convinced that right now, in 1970, our Nation has reached--or, at the very least, is rapidly approaching--the critical point in dealing with its environmental problems.

The American people are beginning to feel this same sense of urgency, although it is true that public ecological awareness was slow in coming. And no wonder--

Modern man has achieved, through the miracles of science and technology, benefits for human life that our ancestors could not even have dreamed of. We have stamped out most of the contagious diseases. We have achieved an unparalleled abundance of food and consumer goods for an ever-growing population. In our own country, and in most of the developed countries of the world, people live longer, are healthier, better nourished, better housed, and better off by almost every measure of ease, comfort, convenience, and security than ever before in the history of man.

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It seems almost unbelievable, in view of the progress that science and technology have made possible, that serious scientists should actually be asking themselves today, "How long can man survive?" in the environment he is creating.

And yet, many are grimly pessimistic. One spokesman at a recent meeting of the Association for the Advancement of Science expressed the view that, if present population and pollution trends continue, the world will become unhabitable in 35 to 100 years. Dr. Paul Ehrlich, the noted ecologist and Professor of Biology at Stanford University, took a scientist's look into the future in a recent magazine article which began with the chilling words: "The end of the ocean came late in the summer of 1979, and it came even more rapidly than the biologists had expected."

Not many of us here today are willing to fully accept these most pessimistic views of impending "eco-catastrophe." But few could deny their basic premise--that pollution and despoliation of the environment, profligate waste of natural resources, and heedless manipulation of the ecosystem, if continued, could, in fact, ultimately destroy the "life-support systems of Spaceship Earth."

In fact, we do not have to peer ahead into the future to the destruction of the planet to feel uneasy about the effects of environmental change on human life. Perhaps we expected too much from technological progress in terms of human liberation--which serves to highlight the gap between hope and fulfillment. As Dr. Rene Dubos, the famous microbiologist, has pointed out, "The age of affluence, technological marvels and medical miracles is paradoxically the age of chronic ailments, of anxiety, and even of despair."

We are only beginning to understand some of the more subtle relationships between man and his environment which seem to create such contradictions. And yet we can detect their presence even in the social behavior which has characterized our recent, troubled times. In recent years in some of our cities, some of the least fortunate of our citizens have tried to destroy an environment that no longer seemed tolerable. In recent years many of our young people turned their backs on a society which they termed "irrelevant" to the real needs of the human spirit and sought escape in a drug-induced substitute for the satisfactions of reality.

In a more constructive vein, I am glad to say, many young people are today turning their energies toward the cause of environmental improvement. In the next two months almost every university in the Nation will take part in a "teach-in" to bring information about environmental problems to public attention.

Even those of us who enjoy the full benefits of our society, and would be loathe to give up any of them, find that the pollution, the crowding, the noise, the impersonality of modern life, the estrangement from the natural world, is not quite the utopia that the technological age seemed to promise, and we feel ourselves borne along helplessly by forces not of our own choosing, which we ourselves have set in motion but seem incapable of controlling.

Perhaps we can better understand these paradoxes if we stop for a moment to consider some aspects of the physical nature of the world we live in, a world which Western man has frequently misperceived.

We cannot afford to forget that we live in a closed life system, in which all elements, including man himself, are related and interdependent. That is so fundamental a truth that it is perceived intuitively by primitive peoples. Man's close relationship to nature was conceptualized, and even systematized, by the ancient scientists and philosophers; and the unchanging laws that govern the universe have long been recognized--if not, of course, fully understood. Yet, for all his science, philosophy, and religious insights, man has behaved for most of his time on earth as though he and his actions were exempt from the natural laws that govern his ecosystem.

In proportion to the earth's size, the layer of air which surrounds it is no thicker than the skin on the surface of an apple. A shallow crust on the earth's surface provides a limited supply of water and other resources on which all life depends and which is constantly recycled and reused in support of the life process. Yet man has used these resources as though he could heedlessly exploit, contaminate, and alter the world about him without endangering the stability and harmony of the system of which he is a part. So long as his numbers were small, and his impact on the environment remained limited and localized, he did not have to pay the price for his shortsightedness; having spoiled one part of the earth, he could move on and leave to nature the long task of repariing the damage.

But recent history has changed all that. Human population has soared. Advances in science and technology have given man a new and awesome power to alter--or even destroy--his environment. His skill and ingenuity in manipulating the environment have produced tremendous benefits to human life. But, more and more, these benefits have been accompanied by frightening, and sometimes irreversible, changes in the ecological system of which he is an integral part. We have wasted precious natural resources, and have devastated much of the earth's natural bounty. Our waste products have grossly polluted the land, air, and water. Moreover, 20th century man is beginning to discover that his basic social and psychological drives are increasingly frustrated by pressures of the artificial, urbanized world which he himself has constructed.

In our own Nation--the most technologically advanced in the world--streams and lakes are dying before their time. Birds, fish, and other wildlife are threatened with extinction. Human health is already affected by the psychic-socio stress of an urbanized industrial environment and by the barrage of microbiological, chemical, and physiological insults which man has injected into this environment; and the survival of future generations is threatened by the seemingly endless buildup of pollutants. Even therapeutic drugs, with their manifest benefits, pose subtle threats when considered as part of the total chemical assault sustained by modern man. And thousands of useful products, from fabrics to television sets, offer potential injury hazards.

We have built cities which people now find almost unlivable; we are confronted on the one hand with "suburban sprawl" and on the other with "rural

blight;" we have built "high-speed" highways on which "high-speed" cars move bumper-to-bumper at horse-and-buggy rates; we have built an industrial system that has given us an affluence never before seen in the world--and that pollutes the very air and water that give us life; we perform miracles of organ transplants, while we drop backward in such measures of human health as infant mortality; we have landed a man on the moon and have not yet figured out what to do with the growing mountains of refuse that litter our countryside.

It seems to me that we cannot fully understand this fantastic situation, or visualize ways of dealing with it, without looking at least briefly at the ways in which the various institutions of our society have traditionally functioned. It seems to be universally characteristic of organized human society to develop specialists; and of course, the more complex society grows, the greater the degree of specialization required. In our own vastly complicated technological society, each of us has had to learn more and more about less. Each of us "tended to his own knitting" as the saying goes and let others tend to theirs. We blithely assumed, I suppose, that if each of the parts of this complex life system worked to perfection, the whole could not fail to operate.

The role of the highway engineer, for example, was to build the most efficient roads at the lowest possible cost--it was not his function to worry about the effect of slashing strips of concrete on the surrounding city or countryside. The business of business, and of agriculture for that matter, was to worry about increased production and favorable balance sheets, not about pollution of air or water. The physician cured the ill, the educator stuck to his classroom, and the social worker to his case histories. The role of the scientist, by long and honored tradition, has been to discover the secrets of his particular specialty, and let someone else determine how these shall be applied.

Government, of course, in any society, attempts to provide the synthesis. And yet, government in a complex society is subject--perhaps especially in a free and diverse society like ours to the same pressures toward specialization that affect other institutions and individuals. So government sets up agencies especially designed and equipped to deal with agricultural problems, or welfare problems, or highway construction--or health or housing or commerce or natural resources, and so on. And we wind up, not with a synthesis, but with an almost mirror reflection of our specialized interests and institutions, each pursuing its own valid, but limited, objectives. The total impact of all these activities on the physical environment - and even on the social, cultural, or economic environment--of human life is still left largely to chance rather than choice.

Max Ways, writing in the February issue of Fortune magazine, discusses this problem in great detail, and sums it up in this way:

"Here we come to the root cause of our abuse of the environment: in modern society the principle of fragmentation, outrunning the principle of unity, is producing a higher and higher degree of disorder and disutility."

In other words, we need better ways of synthesizing and corrdinating the aims and actions of all our institutions if we hope to maintain harmony in the environment. We need to recognize--all of us, whatever our specialized orientation--that the total life system of which we are a part--the natural system and the social, economic, and political systems which we ourselves create--form an interrelated whole. And that every one of millions of every-day decisions--from governmental decisions about tax rates to the farmers' decision about fertilizer or the corporations' decision about product packaging--has ultimately its impact on the kind of life we lead and the kind of world we live it in.

In the last few years, landmark legislation has been passed by the Congress aimed at control of air and water pollution, radiological hazards, and hazards connected with food and drugs. Other measures have been aimed at restoring the urban environment, conserving agricultural and forest lands or preserving the natural areas that are so important to the mind and spirit of man. This session of Congress has passed, and the President has signed, a bill to protect the health and safety of coal miners; and a general occupational health and safety bill is now before the Congress.

There is no question that these various national programs are helping us to slow the progress of environmental degradation. I believe, however, that almost everyone will concede that the pattern of government programs so far has been to react to specific problems in a piecemeal basis, and that this approach simply is not good enough.

On the other hand, the Environmental Policy Act, which the President signed on the first day of the year, establishes a new principle of unified action. It not only defines our purpose of maintaining environmental harmony, but authorizes establishment of a new Council on Environmental Quality in the White House, and requires that all Federal activities be subject to review as to their impact on the environment. President Nixon has appointed Mr. Russell Train, Mr. Fobert Cahn, and Mr. Gordon J. F. MacDonald to serve as his environmental councilors. A Cabinet-level committee had already been formed to coordinate environmental matters, as well as a Citizens' Advisory Committee on the Environment headed by Mr. Laurence Rockefeller.

The proposals made by the President last week are also directed toward a more integrated approach. As I am sure most of you know, these proposals would authorize, for the first time, uniform Federal standards for clean air; they would also strengthen our enforcement procedures, give the Secretary of HEW authority to regulate fuel composition and additives--one of the principal problems associated with pollution from automobiles--and initiate research aimed at production of a virtually pollution-free automobile within five years.

The water pollution control activities of the Department of Interior would be strengthened in similar ways and a new program of Federal assistance to provide municipal sewage treatment plants would be inaugurated--again with a five-year goal of getting these needed facilities into operation.

The President outlined new directions in our solid waste management effort and called for a new approach to the use of Federal lands, as well as full funding of existing programs to provide park and recreational facilities.

I think there is special significance in President Nixon's words to the Congress that maintaining environmental quality calls for "fundamentally new philosophies of land, air, and water use" with all segments of our society called on "to do their share of the job and to pay their share of the cost." It seems to me that this reflects a new kind of ecological wisdom that is increasingly shared by the public, by government at all levels, and by industry as well. I think we are all ready to recognize at last that we cannot adequately deal with the unwelcome by-products of a complex, industrialized society as though they existed outside the total structure of that society.

Before I close, I want to tell you just a little something about the role of my own agency, the Environmental Health Service, in this area. As you know, the Department of Health, Education, and Welfare, has direct responsibility for certain programs of environmental control; and, as the agency primarily concerned for the health and welfare of all citizens, it cannot help but concern itself, in one way or another, with all environmental threats to man. Management of the environment is, as Secretary Finch has put it, "a core problem of the human condition."

We in the Environmental Health Service are presently engaged in a nationwide effort to restore clean air under a plan based on Federal air quality criteria and involving State, local, and public participation in the establishment of air pollution control measures in our major metropolitan areas. In many ways, this program may be regarded as a test of the public will to turn back the tide of pollution. States involved in the designated air quality control regions are required to hold public hearings in arriving at air quality standards. The public has participated actively in these hearings and this has had a most salutary effect on the standards proposed.

As I have mentioned, the President's proposals would alter this program by giving us authority to set uniform Federal standards for air quality throughout the Nation, the States being responsible for enforcing these standards in accordance with approved abatement plans. Federal standards would also be established for specific pollutants from stationary sources that are hazardous to health, and for certain classes of new facilities that could be major polluters.

We already have this kind of authority with regard to pollution from automobile exhausts, with Federal emission standards effective with the 1968 cars. We have just issued new and stronger emission standards for 1973 and 1975 autos to reduce this type of pollution to the lowest possible level attainable by those years.

Under the provisions of recent legislation, we have established standards for radiation emissions from TV sets and are working on such standards for other electronic products that are becoming so much a part of modern life. We are seeking new methods to dispose of our billions of tons of solid waste--and

ways to control the generation of such wastes or to recycle them back onto the production line. We are working to alleviate the hazards to human health and safety which proliferate in the modern occupational setting, and to solve the environmental health problems that plague the unfortunate people of our urban and rural slums. We are studying the effects of noise and seeking ways to reduce this hazard to human health and well being.

As you know, the Secretaries of HEW, Agriculture, and Interior have recently taken action to restrict the use of DDT and other hard pesticides in our own country and are establishing new mechanisms to deal with the use of other pesticides. Other countries, and several States, have banned, or are considering the banning of, those pesticides which resist breakdown and persist in the environment as pollutants.

The Environmental Health Service has an Assistant Administrator and specialists in all program areas in each of the ten Regional Offices of the Department of HEW, and they are ready and anxious to work with you of Agriculture in solving mutual problems. And, if my assessment of public opinion and public policy regarding environmental use is correct, we should be seeing a great deal of each other in the next few years.

Whatever decisions and directions emerge from the current ferment, I believe that saving the environment will unquestionably become a major challenge and issue of the decade we are now entering.

We cannot--and surely we would not want to--return the earth to its condition on the seventh day of creation. But we <u>can</u> avert environmental catastrophe. And we can, if we use our tremendous scientific and technological skills wisely and well, create the kind of world in which human life will be enriched as never before. But we cannot postpone action until tomorrow, or another year, or another decade. As President Nixon has said, "it is now or never."

UNITED STATES DEPARTMENT OF AGRICULTURE
Economic Research Service

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THE ENVIRONMENT AND AGRICULTURE

Talk by T. C. Byerly
Assistant Director of Science and Education
at the 1970 National Agricultural Outlook Conference
Washington, D. C., 3:30 P.M., Tuesday, February 17, 1970

This paper is about the environment. In it I have undertaken to answer the following questions.

1. What is it?

2. What are the major factors and interactions determining the quality of the environment?

3. What is its present condition?

4. What is agriculture's contribution, actual and potential, beneficial and detrimental, to the quality of the environment?

5. What is being done to improve the quality of the environment?

6. What kind of environment do we want?

1. What is the environment?

Simply, it is the aggregate of surrounding things, conditions, and influences. But surrounding what? Surrounding me; surrounding you; surrounding us. Our primary concern is with the environment of which we are a part, of that of which our progeny for generations to come will be a part.

President Nixon, in his State of the Union Message, phrased it this way: "The truly significant environment for each of us is that in which we spend eighty percent of our time--that is, our homes, our places of work and the streets over which we pass."

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But while each of our micro-environments may add up to the global environment, it is not likely that we can understand the global environment by limiting our studies to the niches in which we live.

The "space ship earth" analogy has some conceptual significance. The National Research Council's Geophysical Research Board, in a report of a summer study of the role of ground based research describes the earth as "a giant spin-stabilized spacecraft."[1/]

2. What are the major factors and interactions determining the quality of the environment?

Whether urban or rural, global, terrestrial, aquatic, macro, meso, or micro, environments in which people live do have some common parameters. Somehow we must use measurements of these parameters in developing an index of quality.

A National Academy of Sciences-National Research Council Environmental Studies Board report[2/] just issued suggests that we must monitor and take account of changes in at least the following:

1. Physical and chemical properties of land, air, and water.

2. Distribution of plants and animals in land, air, and water.

3. Land use, including diversity of purpose.

4. Construction.

5. Noise.

6. Epidemiology of man, animals, and plants.

7. Evidence of environmental stress such as tranquilizer consumption and asocial behavior.

8. Aesthetic.

Major determinants of the quality of the environment--in addition to the objective parameters and interactions--include perception of the environment by its inhabitants, perception of specific environments--or habitats--by others--and especially the perception of his own identity by each habitant.

The words aspiration, arrogance, expectation, jealousy, cooperation, conflict, anomia, and frustration describe ways man senses his environment and his part in it. Perception of the environment by any individual, his estimate of himself, the opinion of others, are all-important to the individual's estimate of the quality of the environment.

I commend to your reading an article in the current issue of Agricultural Science Review by Sarah Shoffner of the University of North Carolina at Greensboro: "Self Concept: Its Role in Breaking the Poverty Cycle."[3]

What is good environment? Eric Hoffer relates that he bought a copy of Montaigne's essays, a thousand pages, second hand for a dollar, in anticipation of being snowbound for a winter in the Sierras. He was. He read the book three times. That, he infers, is how he learned to write--in a good environment."[4]

I like the way Hoffer says things. Consider: "The uniquely human fact that discontent is at the root of the creative process, that the most gifted members of the human species are at their creative best when they cannot have their way, and must compensate for what they miss by realizing and cultivating their capacities and talents." Will, in this time of discontent, the environment, the quality of life, provide the challenge required to bring together people of all ages, races, opinions, economic levels, and cultures?

3. What is the present condition of the environment?

The NAS-NAE Environmental Studies Board report of its Environmental Study Group states: "The quality of our lives is directly related to the quality of our environment and the quality of that environment has deteriorated as our national affluence has increased."[5]

There is no gain saying the fact that our air is polluted, and increasingly so, with gaseous and particulate pollutants from burning fossil fuels in automobiles and other transport vehicles, in generation of electricity and household heating. Burning crop wastes, forest wastes, forest fires, trash and garbage, gases and fly ash from factory stacks and refineries add their burden. Odors, too, pollute the air, some from agricultural activities.

Our waters are over burdened with sewage wastes, sediments eroded from roads, construction sites, and poorly managed farm, range, and forest lands. Some nitrogen is leached from farm and forest lands, some pesticide chemicals are carried in runoff water and on sediment into our lakes and streams.

Our land is pocked with abandoned, worked out surface mines--more than three million acres of them. Junk and other solid wastes pollute our landscapes. And residues of pesticide chemicals--arsenic, lead, copper, mercury, organo-chlorines and others pollute our soils. Under and about feedlot areas, nitrogen in excess of any possible usage by growing plants becomes a pollutant to soil, air, plants, and water.

Noise and heat are pollutants growing in importance- as yet they are chiefly of local and urban origin.

Pollution is not a new thing. In many cases, pollution is simply over concentration at particular times and places. Pollution is a function of activity per unit area, of people, animals, industry. It is equally obvious that rapid industrialization of agriculture and the concomitant accelerated urbanization have resulted in deterioration of many urban and rural environments. Shift in traffic patterns, growth in automobile and air traffic, have impaired the quality of life.

4. What is agriculture's contribution to the quality of the environment?

Agriculture in the United States, and in other industrial countries, has increased yields through increasingly effective development and application of technology in crop and livestock production so that; e.g., corn acre yields have gone up three times during the past 35 years (slide 1).

We have >600 million acres of Class I-III land. We harvested crops from less than half. The rest is used for trees and grass and living space--some, unfortunately, goes under pavement every year.

It is only because agriculture is efficient that we may hope to improve the quality of the environment, the quality of life. The productivity of the land, the harvest, and use of water have increased.

On the positive side of the environment, opportunities exist for the wise use of land not needed for farming to provide continuing open space near our cities. Of equal importance is the opportunity for planning the new communities which will be needed for the 100 million additional citizens who will be here in year 2000.

New cultural centers, locations for new industry, new service centers, new recreational centers can be planned to serve both local communities, the States, and the Nation. In addition to assuring land requirements for production of food, fiber, and forest products, we will continue to need coordinated programs for land and urban and industrial development, transportation, outdoor recreation, flood prevention, water harvest, wildlife habitat, and natural beauty (slides 2 and 3).

5. Systems to improve the environment.

In the broadest sense the RC&D multicounty approach, buttressed with every available program, Federal, State, local, public, and private, should be used to improve the quality of the environment, improve the quality of life.

We have the technology to do it. Do we have the determination and dedication?

Narrower in scope, important and urgent, is the development and application of systems which will (1) protect our crops, livestock, ourselves, and our environment from pests without hazardous pollution of the environment, and (2) which will utilize new and efficient technologies for production of meat, milk, poultry, and eggs while recycling the wastes from such operations.

Pollution of the environment with agricultural chemicals--and I do include nitrates in amounts in excess of crop needs as pollutants--can be reduced or avoided. Our systems for doing so are imperfect; they will require more sophistication in their application; they may provide constraints on monoculture.

May I begin with reference to the U.S.D.A. Policy on Pesticides, Secretary's Memorandum No. 1666. Its observance in programs of the USDA is mandatory. The Policy stated is commended to everyone. The memo states that the Department will "practice and encourage the use of those means of effective pest control which provide the least potential hazard to man, his animals, wildlife and other components of the natural environment."

There is ample evidence that integrated control of pests will work. Application of minimal effective dosage of a pesticide only when needed to forestall imminent destruction of the crop will permit predators and parasites to keep many insects in check. Someday we will have effective biological control for many pests but now we have it only for a few.

The application of a pesticide to the target area so that it reaches that area, not downwind fields and woodlands, not left hanging dispersed in the air to drift--and drift--perhaps eventually to fall out in rain or snow, is essential to the limitation of pesticide pollution of the environment. Altitude, flight pattern, speed, wind, all affect the amount of pesticide reaching the target area by aerial application. Licensing and supervision of application is a State and local responsibility. USDA has statutory authority only for supervision in its own programs.

Every farmer is an ecologist of sorts. He manages an ecosystem, an agro-ecosystem, or several of them. As Kellogg and Orvedal have succinctly put it: "Each farmer makes his own arable soil from either a natural soil or an old arable soil. He may change it only a little or he may change it drastically by reshaping the surface for water control, by adding fertilizers to correct plant nutrient deficiencies, by adding other materials to correct acidity or alkalinity or to improve the structure of the soil, or by tilling in depth."[6/] The soil is a living system; treated wisely, it may sustain man and his living associates, plant and animal, generation after generation, with steadily improving productive capacity.

The cotton agro-ecosystem is dominated by a rather uniform population of a single species.

Highest cotton yields are obtained in sunny, long season, irrigated areas. They require abundant, well managed water, suitable soil, adequate fertilization, good genetic stocks, timely tillage, and pest control. Included in the cotton ecosystem are weeds, trash, trees, ditches, ditch banks, roads, fence rows, turn rows, farmsteads, and frequently, intermingled areas of other crops and woodlands and wastelands. The area included must be large enough so that the more significant populations can complete their life cycles within it. There is likely to be substantial movement of species into, within, and out of the system.

Integrated control of cotton pests does include chemical pest control when necessary, that is, when severe crop damage from a particular pest is imminent. The preferred pesticide should be as nearly specific for the particular pest insect as possible.

In the San Joaquin, early pesticide treatment for lygus bugs may be followed by explosive bollworm infestations. Alfalfa strips and delay in lygus bug treatments permit parasites to help keep lygus bug populations in check without bollworm explosion.

In the Lower Rio Grande, bollworms and the tobacco budworm have developed resistance to pesticide chemicals. Omission of early season chemical pesticide treatment in 1969 was followed by yield increases of 20 percent. Pesticide application was halved.

Concentrated pesticide treatment of boll weevils late in the season when they are ready for diapause with very limited use of chemicals in the following season has been reported to control both boll weevil and bollworms on substantial Delta test areas with savings of $4 to $8 per acre.

Because cotton is so heavily dependent on insecticides, because the insect pests of cotton require a variety of chemicals for their control, because chemicals effective against one insect pest may kill the parasites and predators of another pest against which it is not effective; for all these reasons scientists seek to improve and apply integrated control methods for cotton pests.

Integrated systems vary from area to area dependent upon the kind of pests present. The old rainfed areas, from Texas east have the boll weevil, from Texas west to the Imperial Valley, the pink bollworm is a principal pest, and in the San Joaquin, the lygus bug is a continual threat. And the ribiquitous tobacco budworm and cotton bollworm, Heliothis sp., threaten everywhere.

Some weeds can also be controlled by insects. The alligator weed choked many of the water ways in Florida and Louisiana. A flea beetle brought from South America where the weed came from has cleaned up some of the Florida infested area (slides 4, 5, and 6).

Agro-ecosystems in the United States are highly varied--don't let the word throw you. You've thought in terms of types of farming all your lives; dairy--fruit--cash--grain--corn--hog--cotton. Our thinking has focussed on commodities, not systems. But the systems were there. We've been busy building large scale, highly mechanized commodity production systems without sufficient regard for the agro-ecosystems in which commodities are produced and with little regard for waste disposal which is a necessary part of commodity production.

The old McLean County hog system minimized the waste disposal problem. Farrowing houses were distributed over the pasture area--the pasture was part of the system; so was the manure; and so were the worms the pigs recycled. Very often, when pigs reached feeder size, they were placed in the cattle feedlot to glean their food from the cattle droppings.

Now we have confinement systems, feeder pig systems, pathogen-free systems. The trend is toward larger and larger units, continuous production; concentrations of large amounts of waste.

One of our most urgent needs is effective waste disposal systems which do not contaminate air, soil, and water. Lagoon systems, even when they work, discharge nutrient laden effluent into streams.

Let's look briefly at the animal waste load in the U. S. Consider only the more concentrated portions--the following table assumes continual occupancy on "large scale" operations.

DISPOSAL PROBLEM FOR LIVESTOCK WASTES EQUIVALENT TO THE HUMAN WASTE DISPOSAL PROBLEM

Kind of Livestock	Total (January) (Million)	"Large Scale" Operation (Million)	"Large Scale" Human Waste Equivalent Per Head of Livestock	"Large Scale" Human Waste Equivalent Total (Million)
Feedlot cattle	12	5	10	50
Milk cows	14	7	15	105
Laying hens	320	100	0.1	10
Turkeys (raised)	125	50	0.1	5
Broilers	2,600	400	0.05	20
Pigs	54	10	1	10
Lambs on feed	3	2	0.5	1
Total				201

1. Calculated as average through the year

This crude table indicates a disposal problem for livestock wastes equivalent to the human waste disposal problem. I have eliminated all consideration of wastes from city birds, dogs, cats. I have assumed that all livestock dispersed on farms and ranges and all wildlife even more scattered do not constitute a waste disposal problem. It is the most conservative estimate of our waste disposal problem known to me. I estimate that the quantity of animal waste subject to mass disposal methods will double by 1980.

The several solutions include:

1. Composting and ultimate return to the soil.

2. Settling, flocculation, dehydration, or other means of concentration with ultimate return to the soil.

3. Recycling, perhaps selectively, with or without processing as animal feed.

4. Incineration.

5. Laizzez faire.

All of these methods have defects. In many cases, the cost of waste disposal will exceed the value of the waste to the user. These costs may be reflected in price of product or in taxes.

Systems with which we are concerned include the energy system. One burgeoning component of the energy system is electricity. The Office of Science and Technology estimates that 255 new plants will be needed by 1990. They will have a capacity of one million megawatts, three times the capacity of the 3,000 plants now existing. It is probable that 160 plants will have cooling towers by 1990.

Thermal pollution will become a major issue. Location of new plants and burial of transmission lines are issues now. They are environmental issues. Economic and social costs and benefits will be debated throughout the land. This will inevitably be one of the major environmental issues in rural as well as in urban America and in the world.[7]

The Unesco Chronicle for November 1969 quotes (page 40) Moscow University Professors Kalinin and Bykov as follows: "Power is now generated and consumed by industry at such an accelerating rate that this will seriously affect the earth's heat budget.

"If power generated increased annually by ten percent, in 100 years it will have an effect comparable to that of solar radiation."

5. What is being done to improve the quality of the environment?

The following table shows estimated Federal expenditures on pollution related to agriculture in 1969.

ESTIMATED EXPENDITURES ON AGRICULTURAL POLLUTION[8/]

(Million Dollars)

Pollutant	USDA			DOD			DHEW			USDI		
	R&D	Action	Loan	R&D	Action	Loan	R&D	Action	Loan	R&D	Action	Loan
Sediment	4.0	289.3	7.0	0.2	186.8	--	--	--	--	1.3	51.6	--
Animal Waste	1.5	0.8	--	--	--	--	0.5	--	--	0.4	0.7	--
Processing Wastes	1.8	0.9	2.0	--	--	--	0.5	--	--	0.3	12.0	--
Plant Nutrients	1.6	1.2	--	--	--	--	0.1	0.1	--	2.6	2.4	--
Forest and Crop Residues	1.4	24.3	0.1	--	--	--	--	--	--	--	0.3	--
Inorganic salts & minerals	1.2	1.6	14.0	--	--	--	--	--	--	1.7	--	--
Pesticides in the environment	45.9	15.0	--	--	--	--	7.5	2.5	--	1.9	1.9	--
Air pollution related to Agriculture	1.4	10.0	--	--	--	--	3.6	2.0	--	--	--	--
TOTAL	58.8	343.1	23.1	0.2	186.8	--	12.2	4.6	--	8.2	67.9	--

A joint USDA-State Task Force reviewed current research programs, needs, and opportunities in 1968. Aside from the very large continuing research effort on pest control, the Task Force identified a total of about 660 scientist-man-years (SMY's) devoted to research on other forms of pollution in 1966 as shown in the following table. They projected a need for 1,336 SMY's in 1977, more than double the 1966 effort.[9/]

Pollution Research in the USDA, SAES, and Cooperating Forestry Schools (SMY's)

Pollution or subject area	1966	1977
Animal and domestic wastes	27	140
Processing wastes	30	133
Infectious agents, toxins, and allergens	197	270
Sediment	96	254
Plant nutrients	200	275
Mineral and other inorganic substances	44	95
Radioactive wastes	0	10
Airborne chemicals and particulates	41	114
Noise	1	7
Socioeconomic aspects	2	32
Systems analysis	2	6
Total	640	1,336

The Task Force clearly saw the need for systems analysis in solving pollution problems. It also noted a deficiency which still limits the application of systems analysis--a monitoring network such as that proposed under the International Biological Program, a global network of environmental monitoring and local monitoring to guide the systems analysis of local problems. The report quotes Bineck and Taylor,[10/] "When the general problem of waste management and environmental quality is viewed in total, it becomes obvious that solutions to one resource pollution problem may intensify other resource problems--Transfers of pollution problems to other subject matter areas, or legal or bureaucratic jurisdictions are not solutions in any relevant sense."

6. What kind of environment do we want?

Dreams of utopia founder for lack of definition and agreement. It is simple to identify an environmental defect; sensory perception takes care of that. The blind can smell. It is difficult, probably, hopefully, impossible to describe an environment all people would consider ideal.

Criteria and standards for important environmental parameters; e.g., for air quality and water quality, are useful and feasible. But may not focus on such specifics divert us from consideration of the quality of the aggregate environment of which each of us is a part?

Data on ratio of green open space to that covered by buildings and pavement are useful--but again this is a reductionist approach to the environment which can be misleading. Green open space can be a helpful Sirvk for CO_2, for other products of industry. But in the city, green plants may be made hideous by pollutants.

Josh Lederberg, in his January 24 column in the Washington Post quotes Karl Popper,[11/] who wrote: "Social life is so complicated that few men, or none at all, could judge a blueprint for social engineering on a grand scale. . . accordingly, adopt the method of searching for and fighting against, the greatest and most urgent evils of society, rather than searching for, its greater ultimate good."

Lederberg goes on: "Today we have just one reason to voice an exception, [from Popper's argument] the survival of the human community on earth may be utopian ideal.

"For its realization, we have little experience, tools, training, or organization. We lack even the will to proceed with the long range global planning to meet the realities of today's poverty and tomorrow's revolution of hunger and unfulfilled expectations." This is indeed a sobering indictment.

But let us look at our proven competence; at our way of doing things. With all Americans, perhaps with all people, I am proud that "we," the people of the U. S., her scientists, engineers, politicians, and especially her astronauts fulfilled the commitment made by President Kennedy that we would land a man on the moon before 1970.

"Between now and the year 2000, over 100 million children will be born in the U. S. When they grow up--and how--will, more than any one thing, measure the quality of American life in these years ahead."

We have a goal; a goal for each of us. Goals and roles; we in agriculture have played and must continue to play an essential role with respect to the quality of the environment, ergo the qualify of life. Agriculture in the U. S. in its role of supplier of food, fiber, and forest products, is technology dependent. Land and labor have become junior partners, a reversal of traditional relations and a reversal which must take place in all the world.

President Nixon said, "The argument is increasingly heard that a fundamental contradiction has arisen between economic growth and the quality of life, so that to have one, we must forsake the other.

"The answer is not to abandon growth but to redirect it."

Elvis Starr,[12/] President of the National Audobon Society, put it another way in his speech to the San Francisco Conference of the U. S. National Commission for Unesco. He said: "The value choices must be made first, and then the technologists and engineers brought into play, in support of these choices. Technologists and engineers are people, too, and as people have responsibility for sharing in those value choices."

Of course, we've been making value choices and achieving them in Agriculture since that art began; we planted in order to harvest. We cared for brood stock in order to harvest the offspring. We managed forest and range in order to achieve sustained yield.

Our record of goal achievement--and over achievement--is remarkable.

Conclusion

The efficiency of agriculture is a major determinant in the quality of our environments--rural, urban, local, global. For as agriculture produces food, fiber, and forest products efficiently, land and associated resources are released for other uses and for enjoyment.

Agricultural pollution can be resolved by development and application of systems which are technologically effective and socially and economically acceptable.

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